Red Grouper Interim Rule: Bag Limit and Seasonal Closure Analyses, with Associated Impacts on Other Groupers

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Introduction

Secretarial Amendment 1 to the Reef Fish Fishery Management Plan (FMP) established a red grouper rebuilding plan based on a three-year interval rebuilding strategy. The annual Allowable Biological Catch (ABC) during the first three-year interval (2003-2005) of the rebuilding plan is 6.56 million pounds gutted weight (mp gw), of which 1.25 mp gw (19 percent) is allocated to the recreational fishery. In both 2003 and 2004, recreational red grouper landings exceeded the 1.25 mp gw recreational allocation. Landings in 2003 were only slightly greater than the allocation and totaled 1.348 mp gw. In 2004, landings were nearly 2.5 times greater than the recreational allocation, totaling 3.099 mp gw[1].

During the March 2005 Council meeting in Birmingham, Alabama, the Council requested NOAA's National Marine Fisheries Service (NMFS) develop an interim rule to bring the 2005 recreational harvest of red grouper within their target catch levels as specified in Secretarial Amendment 1 to the Reef Fish FMP. This report evaluates management measures that would reduce the likelihood of red grouper harvest exceeding the recreational allocation in 2005.

Harvest Reduction

Recreational red grouper landings for 2005 are currently unknown; therefore the reduction necessary to meet the recreational allocation is dependent on assumptions about future red grouper harvest in 2005. If harvest reductions are based on average recreational landings during the rebuilding plan (2003-2004), a 43.8 percent reduction in harvest is needed to reduce the 2005 harvest to 1.25 mp gw. However, if 2005 landings were similar to 2003 landings only a 7.3 percent reduction in harvest would be needed; whereas a 59.7 percent reduction in harvest would be necessary if landings in 2005 are similar to landings in 2004.

Preliminary 2005 Wave 1 Marine Recreational Fisheries Statistics Survey (MRFSS) red grouper landings are lower than landings observed during both 2003 and 2004. Preliminary Wave 1 red grouper landings in 2005 totaled 125,789 pounds gw. In 2003 and 2004, Wave 1 red grouper landings totaled 143,352 pounds gw and 168,578 pounds gw, respectively. There is a weak positive correlation between Wave 1 MRFSS landings (1990-2004) and total annual MRFSS landings ($r^2 = 0.39$; Figure 1), indicating Wave 1 MRFSS landings are not a strong predictor of annual MRFSS landings. However, it should be noted annual red grouper landings have never exceeded 2.03 mp gw in years when Wave 1 landings were less than 150,000 pounds gw.

Historical trends in recreational red grouper landings provide two instances when landings declined significantly following a year with very large increase in recreational landings (Figure

[1] These landings represent finalized MRFSS estimates for 2004

2). Landings increased 41 percent in 1992 and 47 percent in 2000 compared to landings during previous years. In 1993 and 2001, recreational landings declined 34 and 57 percent, respectively, following these high years of landings. These years of high landings appear to be the result of strong year classes recruiting to the fishery (Carlson et al. 2002). In 2003 and 2004, a large percentage of MRFSS intercepts (10-22 percent) reported landing undersized red grouper (< 20 inches total length [TL]), lending evidence that the large increase in landings during 2004 may be the result of another strong year-class recruiting to the fishery. Non-standardized nominal catch rates also increased between 2002 and 2004 (Thompson 2005), potentially indicating increased availability.

Recreational landings vary widely from one year to the next. Since 1986, recreational red grouper landings have averaged 1.80 mp gw. The standard deviation of landings during this time series has been ± 0.70 mp gw. Recreational landings have ranged from a low of 0.65 mp gw in 1997 to a high of 3.06 mp gw in 2004. Since 2000, when the new MRFSS charterboat survey was implemented, landings have averaged 1.94 mp gw (± 0.71 standard deviation).

Based on historical landings data and year-to-year fluctuations in recreational landings, 2005 landings will likely be lower than 2004. The degree to which 2005 landings will be less than 2004 landings is unknown. The following analyses and results present a wide range of percent reductions that could be considered for the interim rule.

Current Recreational Management Regulations

The following regulations currently apply to the recreational Gulf of Mexico grouper fishery:

1) Two red grouper bag limit (Secretarial Amendment 1, implemented July 15, 2004);
2) five grouper aggregate bag limit (includes shallow and deep-water groupers; Amendment 1, implemented January 22, 1990);
3) ABC of 6.56 mp, of which 1.25 mp is allocated to the recreational fishery (Secretarial Amendment 1, implemented July 15, 2004); and,
4) 20 inch TL size limit (Amendment 1, implemented January 22, 1990)

Management Options Considered in this Report

The following management options were evaluated in this report to estimate reductions in recreational harvest:

1) Reducing the red grouper bag limit from 2 to 1 fish;
2) reducing the aggregate grouper bag limit from 5 to either 4 or 3 fish;
3) seasonal closures during July through December; and,
4) bag limit and seasonal closure combinations.

Methods

Data sources

Landings data for Gulf of Mexico grouper were obtained from the NMFS MRFSS and Southeast Fishery Science Center's Headboat Survey. MRFSS intercept files and Headboat catch-effort files were used to evaluate reductions in red grouper and aggregate grouper bag limits. MRFSS estimation files and Headboat catch-estimate files were used to calculate landings (numbers of fish) by wave or month. Landings and catch data for headboats were not available for 2004, so the years 2002-2003 were used for analyses. The years 2003-2004 were used for MRFSS analyses.

Bag limit analyses

Bag limit reductions were analyzed following modified methods presented in Brooks (2003). Two analyses were conducted to evaluate the effects of reducing the red grouper bag limit and reducing the aggregate grouper bag limit (shallow and deep water groupers).

The MRFSS system classifies recreational catch into three categories:

- Type A - Fish that were caught, landed whole, and available for identification and enumeration by the interviewers.
- Type B - Fish that were caught but were either not kept or not available for identification.
    - Type B1 - Fish that were caught and filleted, released dead, given away, or disposed of in some way other than Types A or B2.
    - Type B2 - Fish that were caught and released alive.

All catch types A, B1 and B2 were recorded on a per-person basis. Type A catch, which is recorded for only the trip's leader, was divided by the number of people that contributed to the total A catch. Some or all of the people contributing to the A catch are also interviewed for type B1 and B2 catch, and those are recorded on an individual basis. If the number of people contributing to the A catch was greater than the number of people contributing to the B catch, an estimate was made to account for possible under reporting of the B catch. Only the estimate of type A catch per person was compared to the bag limit. If the estimate of type A catch per person was greater than the limit, the value was re-set to the limit (A_{limit}). If type A catch was less or equal to the limit, then the value was retained.

Red Grouper Bag Limit Analyses

If Type A <= bag limit, then total harvest = A + B1

If Type A > bag limit, the total harvest = A_{limit} + B1

Aggregate Grouper Bag Limit Analyses

If Type A_{RG} <= 1 and $A_{ALL\ GROUPERS}$ <= aggregate bag limit, then total harvest = A_{RG} + $A_{ALL\ GROUPERS\ -\ RG}$ + B1

If Type A_{RG} <= 1 and $A_{ALL\ GROUPERS}$ >= aggregate bag limit, then total harvest = A_{RG} + ($A_{LIMIT\ ALL\ GROUPERS}$ - A_{RG}) + B1

If Type A_{RG} >= 1 and $A_{ALL\ GROUPERS}$ <= aggregate bag limit, then total harvest = $A_{LIMIT\ RG}$ + ($A_{ALL\ GROUPERS}$ – A_{RG}) + B1

If Type A_{RG} >= 1 and $A_{ALL\ GROUPERS}$ >= aggregate bag limit, then total harvest = $A_{LIMIT\ RG}$ + ($A_{LIMIT\ ALL\ GROUPERS}$ – $A_{LIMIT\ RG}$) + B1

Reductions in harvest were estimated by dividing the total catch exceeding a particular bag limit by average annual landings. Harvest reductions were adjusted to account for non-compliance (i.e., exceeding red grouper or aggregate bag limits) by subtracting the reduction associated with a five fish bag limit from the reductions associated with smaller bag limits.

Estimated reductions for headboat data were calculated in a similar manner, except no data were available for unseen harvest (B1). Catch per person (type A) was calculated by dividing the total number of fish landed by the total number of anglers on the boat. If the catch per angler was greater than the limit (A_{limit}), the value was re-set to the limit, as described above.

Red Grouper Bag Limit Analyses

If $Catch_{RG}$ <= bag limit, then total catch = A

If $Catch_{RG}$ >= bag limit, then total catch = A_{LIMIT}

Aggregate Grouper Bag Limit Analyses

If $Catch_{RG}$ <= 1 and $Catch_{\ ALL\ GROUPERS}$ <= aggregate bag limit, then total harvest = A_{RG} + $A_{ALL\ GROUPERS\ -\ RG}$

If $Catch_{RG}$ <= 1 and $Catch_{\ ALL\ GROUPERS}$ >= aggregate bag limit, then total harvest = A_{RG} + ($A_{\ LIMIT\ ALL\ GROUPERS}$ - A_{RG})

If $Catch_{RG}$ >= 1 and $Catch_{\ ALL\ GROUPERS}$ <= aggregate bag limit, then total harvest = $A_{LIMIT\ RG}$ + ($A_{\ ALL\ GROUPERS}$ – A_{RG})

If $Catch_{RG}$ >= 1 and $Catch_{\ ALL\ GROUPERS}$ >= aggregate bag limit, then total harvest = $A_{LIMIT\ RG}$ + ($A_{LIMIT\ ALL\ GROUPERS}$ – $A_{LIMIT\ RG}$)

Average harvest reductions from headboat and MRFSS were then weighted according to the proportion of landings from each source to determine the overall reduction for various bag limits. Between 2002 and 2003, MRFSS accounted for 97.5 percent of red grouper landings and 96.7 percent of recreational grouper landings. During this same time period, the headboat fishery

accounted for 2.5 percent of recreational red grouper landings and 3.3 percent of recreational grouper landings.

Seasonal closure analyses

MRFSS and headboat landings (numbers of fish) were averaged by wave or month and the percentage of landings during each month or wave was calculated. The percent landings for each wave were divided by two to estimate the percent landings occurring for each month within a wave. Harvest reductions resulting from seasonal closures were then calculated by summing the average headboat and MRFSS landings during the proposed closure months by the total average annual recreational landings. Separate harvest reductions were calculated for red grouper and for all groupers. Seasonal closure analyses did not incorporate release mortality or changes in effort shifting.

Combination analyses

The effects of a red grouper bag limit, an aggregate grouper bag limit, and seasonal closures were estimated using the following equations. Estimated reductions for 2005 assumed the one fish bag limit would be implemented beginning July 1. Because of the recent implementation of the two fish bag limit, reductions in harvest were assumed to occur during January through June.

Estimated Red Grouper Reductions

2005 Percent Reduction = (total red grouper landings – (seasonal closure red grouper landings + (Jan-June red grouper landings × % reduction 2 fish red grouper bag limit) + (Jul-Dec non-closure month red grouper landings × % reduction 1 fish red grouper bag limit))/ total red grouper landings

Annual reduction estimates were calculated in a similar manner as 2005 reduction estimates, except the one fish bag limit was assumed to be effective beginning January 1.

Annual Percent Reduction = (total red grouper landings – (seasonal closure red grouper landings + (Jan-Dec non-closure month red grouper landings × % reduction 1 fish red grouper bag limit))/total red grouper landings

Estimated Aggregate Grouper Reductions

2005 Percent Reduction = (total grouper landings – (seasonal closure grouper landings + (Jan-June red grouper landings × % reduction 2 fish red grouper bag limit) + (Jul-Dec non-closure month landings × % reduction 1 fish red grouper/4, 3 or 2 fish aggregate grouper bag limit))/total grouper landings

Annual reduction estimates were calculated in a similar manner as 2005 reduction estimates, except the one fish red grouper bag limit and lower aggregate grouper bag limit were assumed to be effective beginning January 1.

Annual Percent Reduction = (total grouper landings – (seasonal closure grouper landings + (Jan-Dec non-closure month landings × % reduction 1 fish red grouper/4, 3, or 2 fish aggregate grouper bag limit))/total grouper landings

Results

Reducing the red grouper bag limit to one fish would reduce the annual red grouper harvest by 21.9 percent and the 2005 red grouper harvest by 14.8 percent (Table 1). Because of the recent implementation (July 2004) of the two fish red grouper bag limit, reductions in harvest were also estimated for a two fish bag limit. During January through June 2005 it is estimated the two fish bag limit would reduce harvest by 6.0 percent (Table 1).

A total of 2,906 MRFSS intercepts and 2,270 headboat trips reported catching and/or harvesting red grouper. Only two MRFSS trips harvested more than five red grouper per angler, and 245 trips harvested more than one red grouper per angler (Table 2). No headboat trips harvested more than two red grouper per angler and only 8 trips harvested more than one red grouper per angler (Table 2).

Reducing the red grouper bag limit to one, combined with a 2, 3, or 4 grouper aggregate bag limit would reduce the annual grouper harvest by 10.5 to 23.8 percent and the 2005 grouper harvest by 6.5 to 13.5 percent (Table 3). A 4, 3, or 2 fish aggregate bag limit would reduce the annual harvest of groupers, excluding red grouper, by 3.3, 10.0, and 22.9 percent, respectively (Table 4). The 2005 harvest of groupers, excluding red grouper, would be reduced by 1.8, 5.2, and 12.0 percent if a 4, 3, or 2 fish aggregate bag limit is implemented, respectively (Table 4).

A total of 5,584 MRFSS intercepts and 4,141 headboat trips reported catching and/or harvesting grouper. Reducing the aggregate bag limit to four and the red grouper bag limit to one would have affected 306 MRFSS trips and 9 headboat trips (Table 4). A three grouper aggregate bag limit combined with a one red grouper bag limit would have affected 360 MRFSS trips and 14 headboat trips (Table 5).

Reductions in red grouper harvest resulting from closures during July through December ranged from 4.1 to 55.2 percent depending on the month(s) closed and duration of the closure (Table 6). During July through December, the months of July and August accounted for 32.4 percent of the annual red grouper harvest, the months of September and October accounted for 14.5 percent of the annual red grouper harvest, and the months of November and December accounted for 8.3 percent of the annual red grouper harvest. A two- to six-month closure would be needed to reduce red grouper harvest by 25 percent or more, if the red grouper bag limit is not reduced from two to one fish. The largest reductions in harvest occur during closure periods when either July, August, or both months are closed, in addition to other monthly closures. A six-month closed season from July through December would reduce red grouper harvest by 55.2 percent.

The months of November-December account for 14.3 percent of the annual grouper (shallow and deep-water groupers) landings, while July-August and September-October account for 22.9 and 16.3 percent of the annual grouper harvest, respectively (Table 6). An August-October closure would reduce grouper harvest by 27.4 percent, whereas a July-December closure would reduce

harvest by 52.7 percent (Table 6). The largest estimated reductions in harvest were for closed seasons that included either the month of July, the month of August, or both months.

The effects of combining a one fish red grouper bag limit with a red grouper seasonal closure are summarized in Table 7. A November closure and one red grouper bag limit results in the smallest estimated 2005 harvest reduction (18.0 percent). Closing July or August with a one red grouper bag limit would reduce harvest by 27.6 percent in 2005. An October-December closure combined with a one fish bag limit would reduce the 2005 harvest by 27.2 percent and a September-December closure combined with a one fish bag limit would reduce the 2005 harvest by 32.8 percent. A 57.9 percent reduction in the 2005 grouper harvest would occur if a one fish red grouper bag limit is combined with a six-month seasonal closure (July – December).

The effects of combining a one fish red grouper bag limit with a lower aggregate bag limit and seasonal closure for all groupers are summarized in Table 8. If the one red grouper bag limit is combined with a lower aggregate bag limit and a seasonal closure for all groupers, the overall reduction in the 2005 grouper harvest would range from 12.9 to 52.7 percent depending on the month(s) closed, duration of the closure, and reduction to the aggregate bag limit (Table 9). A December closure combined with a one fish red grouper bag limit and four fish aggregate grouper bag limit would result in the smallest estimated 2005 harvest reduction (12.9 percent), whereas a six-month closure, one fish red grouper bag limit and 4, 3, or 2 fish aggregate bag limit would result in the largest 2005 harvest reduction (53.7 percent). Three to four month closures combined with a one red grouper bag limit and 3 or 4 grouper aggregate bag limit would reduce harvest by 25 percent or more.

Discussion

The results of these bag limit and closed season analyses are dependent on several assumptions, which could affect the overall results. Seasonal closure estimates do not account for effort shifting. Effort shifting could reduce the estimated seasonal reductions in harvest if fishermen increase fishing effort during open months before or after the closed season. The results of these analyses are also dependent on historical data, which are assumed to represent fishery conditions in 2005. Changes to the distribution of landings by month or wave would alter the expected reductions resulting from closed seasons. Additionally, if catch rates increase or decrease, the estimated reductions in harvest resulting from bag limits could be under or overestimated.

It should be noted fishery reductions are often overestimated and the actual reduction achieved is typically less than originally estimated. This can be due to a number of factors, including but not limited to, increases in fishing effort (trips), changes in catch rates, and changes in fishermen behavior (e.g., changes in species targeted). For example, the estimated red grouper bag limit reductions presented herein are lower than the reductions estimated for Secretarial Amendment 1 to the Reef Fish FMP. Differences in the reduction estimates are likely due to the use of a more recent time series and changes in catch rates. A two fish bag limit was estimated to reduce harvest by 9 percent in Secretarial Amendment 1. This estimated reduction used landings data from 1996-1999. The current bag limit analysis used the two most recent years of landings data and estimated a 6 percent reduction in red grouper harvest resulting from a two fish bag limit

Overall, the results of this report indicate reducing the red grouper bag limit from two to one will only reduce harvest by 14.8 percent in 2005. To achieve greater red grouper harvest reductions in 2005, a closed season would have to be implemented in addition to a one red grouper bag limit. Reducing the aggregate bag limit or including all groupers in the recreational closed season could positively benefit all groupers by reducing potential negative effects due to shifts in effort associated with red grouper management actions.

Citations

Lombardi-Carlson, L.A., G.R. Fitzhugh, and J.J. Mikulas. 2002. Red grouper (*Epinephelus morio*) age-length structure and description of growth from the eastern Gulf of Mexico: 1992-2001. NMFS, SEFSC, Panama City, Florida. Contribution 2002-06.

Thompson, N.B. 2005. Red grouper trip and bag limit advice. February 15, 2005, memorandum from Nancy B. Thompson to Wayne Swingle. NMFS, SEFSC, Miami, Florida.

Table 1. Estimated harvest reductions for various red grouper bag limits.

Bag Limit	2005 Reduction*			Annual Reduction**		
	MRFSS	Headboat	Total	MRFSS	Headboat	Total
2	6.2	0.0	6.0	6.2	0.0	6.0
1	15.1	0.5	14.8	22.4	0.8	21.9

* 2005 reductions for 2 fish bag limit equal annual reductions because 2 fish bag limit would be in effect for the entire year; one fish bag limit assumes one red grouper bag limit implemented July 1 and from January to June, two fish bag limit would reduce MRFSS and headboat harvest

** estimated reduction if bag limit is in effect the entire year

Table 2. Number of MRFSS and Headboat trips affected by various red grouper bag limits.

Red Grouper Bag Limit	Intercepts	
	MRFSS	Headboat
5	2	0
4	9	0
3	20	0
2	74	0
1	245	8
Total	2906	2270

Table 3. Estimated harvest reductions for a one fish red grouper bag limit and various aggregate grouper bag limits.

Bag Limit		2005 Reduction*			Annual Reduction**		
Red Grouper	Aggregate	MRFSS	Headboat	Total	MRFSS	Headboat	Total
1	4	6.8	0.1	6.5	10.9	0.2	10.5
1	3	9.2	0.2	8.9	15.6	0.4	15.1
1	2	14.0	1.0	13.5	24.6	1.7	23.8

* assumes new aggregate bag limit implemented July 1; red grouper landings during Jan-Jun were reduced using the percent reduction for a two fish bag limit

** estimated reduction if bag limit is in effect the entire year

Table 4. Estimated harvest reductions for a red grouper and all other groupers resulting from a one fish red grouper bag limit and various aggregate grouper bag limits.

Bag Limit		2005 Reduction		Annual Reduction	
Red Grouper	Aggregate	Red Grouper	Other Grouper	Red Grouper	Other Grouper
1	4	14.8	1.8	21.9	3.3
1	3	14.8	5.2	21.9	10.0
1	2	14.8	12.0	21.9	22.9

Table 5. Number of MRFSS and Headboat trips affected by a one red grouper bag limit and various aggregate grouper bag limits.

Red Grouper Limit, Aggregate Limit	Intercepts	
	MRFSS	Headboat
1, 4	306	9
1, 3	360	14
1, 2	484	37
1, 1	811	214
Total	5584	4141

Table 6. Estimated red grouper harvest reductions for various seasonal closures.

Closed Season	Estimated Reduction		
	Red Grouper	Other Grouper	All Grouper
Nov	4.2	9.0	7.2
Dec	4.1	8.8	7.1
Sep	7.2	8.7	8.1
Oct	7.3	8.8	8.2
Nov-Dec	8.3	17.8	14.3
Oct-Nov	11.5	17.7	15.7
Sep-Oct	14.5	17.4	16.0
Oct-Dec	15.6	26.6	22.8
Jul	16.2	8.0	11.4
Aug	16.2	8.0	11.5
Sep-Nov	18.7	26.4	23.1
Sep-Dec	22.8	35.2	30.7
Aug-Sep	23.4	16.7	18.9
Aug-Oct	30.7	25.4	27.4
Jul-Aug	32.3	16.0	22.5
Aug-Nov	34.9	34.4	34.9
Aug-Dec	39.0	43.2	41.3
Jul-Sep	39.5	24.7	29.9
Jul-Oct	46.9	33.4	38.0
Jul-Nov	51.1	42.4	45.6
Jul-Dec	55.2	51.3	52.7

Table 7. Red grouper harvest reductions for a one fish red grouper bag limit combined with various seasonal closures for red grouper.

Closed Season	Estimated Reduction	
	2005*	Annual**
None	14.8	21.9
Nov	18.0	25.1
Dec	18.3	25.1
Sep	20.6	27.5
Oct	20.7	27.6
Jul	27.6	34.5
Aug	27.6	34.5
Nov-Dec	21.5	28.4
Oct-Nov	24.0	30.9
Sep-Oct	26.3	33.3
Aug-Sep	33.2	40.1
Jul-Aug	40.2	47.1
Oct-Dec	27.2	34.1
Sep-Nov	29.6	36.5
Aug-Oct	38.9	45.8
Jul-Sep	45.7	52.7
Sep-Dec	32.8	39.8
Aug-Nov	42.1	49.1
Jul-Oct	51.4	58.5
Aug-Dec	45.3	52.4
Jul-Nov	54.7	61.8
Jul-Dec	57.9	65.0

* assumes red grouper bag limit will be reduced from 2 to 1 fish on July 1, 2005; red grouper landings during Jan-Jun were reduced using the percent reduction for a two fish bag limit

** assumes red grouper bag limit is effective the entire year

Table 8. Harvest reductions for all grouper resulting from a one fish red grouper bag limit combined with various aggregate grouper bag limits and seasonal closures for all groupers.

Closed Season	Red Grouper limit	2005 Reduction*			Annual Reduction**		
		agg limit 4	agg limit 3	agg limit 2	agg limit 4	agg limit 3	agg limit 2
None	1	6.5	8.9	13.5	10.5	15.1	23.8
Nov	1	13.0	15.1	19.1	17.0	21.3	29.4
Dec	1	12.9	15.0	19.0	16.9	21.1	29.3
Sep	1	13.8	15.8	19.7	17.8	22.0	30.0
Oct	1	13.9	15.9	19.8	17.9	22.1	30.1
Jul	1	16.4	18.3	21.9	20.4	24.5	32.2
Aug	1	16.4	18.3	21.9	20.4	24.4	32.2
Nov-Dec	1	19.4	21.1	24.5	23.4	27.3	34.8
Oct-Nov	1	20.4	22.1	25.4	24.4	28.3	35.7
Sep-Oct	1	21.2	22.8	26.0	25.2	29.0	36.3
Aug-Sep	1	23.7	25.2	28.1	27.7	31.3	38.4
Jul-Aug	1	26.3	27.6	30.3	30.3	33.8	40.6
Oct-Dec	1	26.8	28.1	30.8	30.8	34.3	41.1
Sep-Nov	1	27.7	29.0	31.5	31.7	35.1	41.9
Aug-Oct	1	31.0	32.2	34.4	35.0	38.3	44.7
Jul-Sep	1	33.5	34.5	36.5	37.5	40.7	46.8
Sep-Dec	1	34.0	35.0	37.0	38.0	41.2	47.3
Aug-Nov	1	37.5	38.3	39.9	41.5	44.5	50.2
Jul-Oct	1	40.9	41.5	42.8	44.9	47.7	53.1
Aug-Dec	1	43.9	44.4	45.3	47.9	50.5	55.6
Jul-Nov	1	47.4	47.7	48.3	51.4	53.9	58.6
Jul-Dec	1	53.7	53.7	53.7	57.7	59.9	64.0

* assumes new aggregate bag limit implemented July 1; red grouper landings during Jan-Jun were reduced using the percent reduction for a two fish bag limit

** estimated reduction if aggregate bag limit is effective the entire year

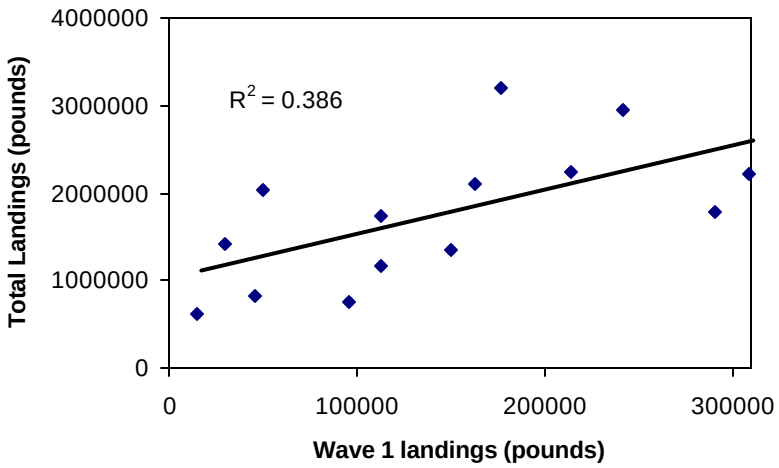

Figure 1. Relationship between Wave 1 and annual MRFSS red grouper landings.

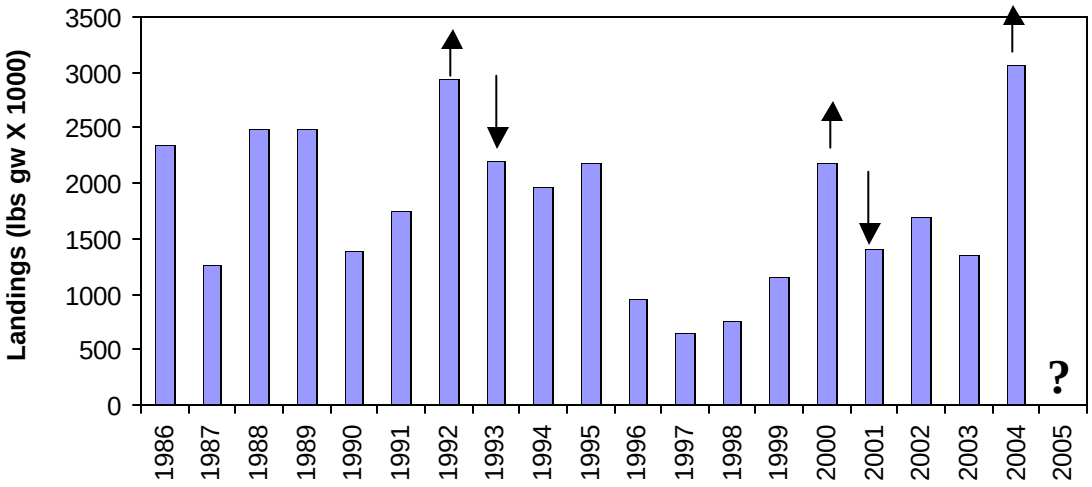

Figure 2. Annual recreational red grouper landings, 1986-2004.

Addendum

Following completion of this report the Southeast Fisheries Science Center reviewed the results of these analyses and suggested including MRFSS unseen red grouper harvest (type B1 catch) in the bag limit analyses. Two additional changes were made to the bag limit analyses that differ from those presented in this report. The first change is percent reductions were weighted by mode using 2003-2004 landings. Previously, reductions in MRFSS (charter + private) and headboat data were weighted, but reductions were not weighted for charter boat landings and private boat landings. Data were reweighted because a majority of the intercepts in the MRFSS database were from the charter boat sector, but a majority of the landings were from the private/rental boat sector. The second change included using 2003-2004 headboat landings, rather than 2002-2003 headboat landings. Headboat landings were previously not available for incorporation into the original report.

The following tables summarize reductions resulting from the aggregate bag limit. Harvest reductions resulting from lowering the red grouper bag limit are summarized in Strelcheck (2005).

Table 1. Estimated harvest reductions in overall grouper harvest resulting from a one red grouper bag limit and various aggregate grouper bag limits.

Bag Limit		Mode			
Red Grouper	Aggregate	Private	Charter	Headboat	All
1	4	12.9	9.6	1.2	11.9
1	3	15.9	14.6	1.8	15.1
1	2	22.7	24.3	3.9	22.1

Table 2. Estimated harvested reductions for red grouper and all other groupers resulting from a one fish red grouper bag limit and various aggregate grouper bag limits.

Bag Limit		Species	
Red Grouper	Aggregate	Red Grouper	Other Grouper
1	4	27.9	2.5
1	3	27.9	7.4
1	2	27.9	18.6

Additionally, an arithmetic error was discovered when updating the interim rule aggregate bag limit calculations for the regulatory amendment. Corrected results are summarized in Table 3 below. Overall, reductions in harvest resulting from the aggregate bag limit remain unchanged for headboats and are slightly less than previously calculated for MRFSS, resulting in slightly lower total reductions in harvest.

Table 3. Estimated harvest reductions for a one red grouper bag limit and various aggregate grouper bag limits.

Bag Limit		2005 Reduction*			Annual Reduction**		
Red Grouper	Aggregate	MRFSS	Headboat	Total	MRFSS	Headboat	Total
1	4	6.6	0.1	6.4	10.5	0.2	10.2
1	3	8.8	0.2	8.5	14.8	0.4	14.3
1	2	13.2	1.0	12.8	23.2	1.7	22.5

* assumes new aggregate bag limit implemented July 1; red grouper landings during Jan-Jun were reduced using the percent reduction for a two fish bag limit

** estimated reduction if bag limit is in effect the entire year

References

Strelcheck, A.J. 2005. Bag and vessel limit analyses for the red grouper regulatory amendment. NMFS, SERO, St. Petersburg, FL. 7 p.